update
UNITED NATIONS CENTRE FOR SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

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Conference to Explore Military Conversion

The conversion of military-industrial complexes to more constructive civilian uses will be the subject of a three-day conference in Dortmund, Germany, from 24 to 27 February 1992.

The conference will explore opportunities for development and environmental protection, with special emphasis on the role of science and technology. Speakers will examine, among other things:

- the political, economic and legal conditions for the process of conversion, and the role of the United Nations;
- options for reinvesting any "peace dividend" which might result from declining military budgets on such things as disaster relief, environmentally sound technologies, waste management and the recycling of military hardware;
- the technical feasibility of conversion, including institutional obstacles to a restructuring of nations' priorities; and
- policy options, including the transfer of technologies and know-how to developing countries.

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The end of the cold war and the scaling down of military conflict and tensions in parts of the developing world have raised hopes that leaders will seize an historic opportunity to direct their attention to productive human endeavours which might be financed from savings in military budgets or could accrue from the peaceful application of military technologies. One of these dual-use technology areas is the aerospace industry, which could, among other things, facilitate global monitoring of natural resources and global information networks for education and communications.

As political leaders become more sensitive to shared global threats such as global warming, new definitions of "security" are emerging. At the United Nations, the concept of global security has expanded beyond military concerns to embrace the need for sustainable patterns of human development and respect for the natural resource base upon which the future of humankind depends.

It is hoped that the Dortmund conference will summarize emerging perceptions of military conversion and demonstrate, through case studies, ways in which international co-operation might establish a framework for action in specific areas related to science and technology.

Participants will include international experts from United Nations organizations, and decision-makers from industry, the scientific community and government. About one third of the 150 invited participants will be from developing nations.

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BRIAN LIES

New UNU Institute to Open Soon

The United Nations University is expected to open an Institute for New Technologies (INTECH) in Maastricht, the Netherlands, in March of 1992.

The Institute will be the third research and training centre to be established by the UNU. Its initial focus will be on the implications of biotechnologies and micro-electronics for the development strategies of developing countries and its activities will be carried out in co-operation with institutions in both the developing and the industrialized countries. INTECH will draw on the work of economists, political scientists and sociologists and will provide training in technology forecasting and assessment for third world nationals.

The Government of the Netherlands has made an initial contribution of about $14 million towards the running of the centre. ■

BRIAN LIES

(Cont. from Pg. 1)

The conference will be sponsored by the State Ministry for Science and Research of North Rhine-Westphalia and the United Nations. The organizers are the Institute for Environmental Protection (INFU) of the University of Dortmund and the United Nations Centre for Science and Technology for Development (CSTD), in close cooperation with the United Nations Department for Disarmament Affairs and other United Nations organizations.

For further information about the conference and its agenda, please contact:

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Technology Forecasting

A seminar on "Technology Monitoring Assessment and Forecasting" will be held in Maastricht, the Netherlands, in April, 1992. The seminar will be organized by CSTD and DIESA to promote policy discussion through some 35 experts from developed and developing countries. The aim is to improve the criteria and methodologies for forecasting and monitoring used by Governments and international organizations which are active in this field.

The meeting is being prepared in cooperation with the Institute for New Technologies (INTECH) of the United Nations University, DIESA, UNIDO and UNESCO. ■

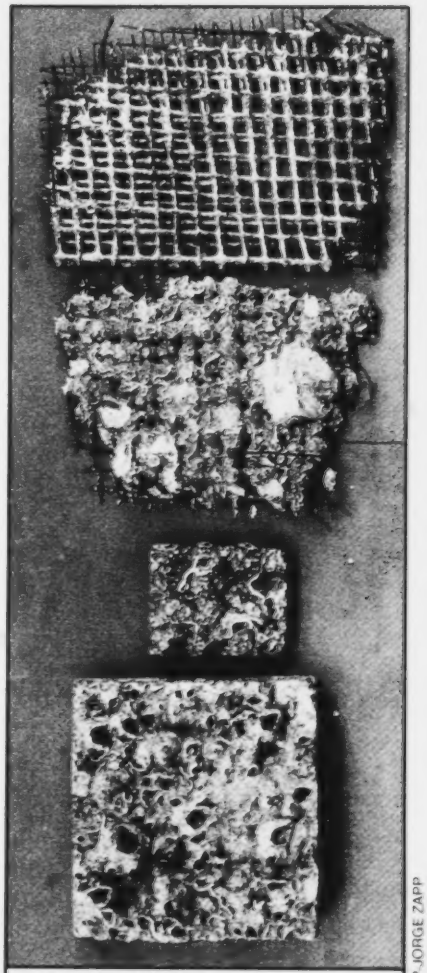
Coral Construction for the Developing World

On the warm Caribbean coast of Colombia, technicians have been employing tiny marine organisms to build paving slabs, sewerage pipes and even boats.

Mr. Jorge Zapp, a Colombian engineer and technical advisor to the United Nations Development Programme (UNDP), leads a team which has been experimenting with electro-accretion, a process by which living marine organisms rapidly accumulate around wire mesh charged with a low electrical current. The result is a tough, durable coating of concrete hard coral grown to virtually any shape required.

Electro-accretion was discovered accidentally 150 years ago when British scientist Michael Faraday tried to separate sea water into hydrogen and oxygen. His efforts were thwarted when hard calcium carbonate gathered around his electrified wire. Following up in the late 1970s, American scientist Wolf Hilbertz found that a two- or three-amp charge was sufficient to build a hardened casing on wire mesh at a rate of about 1.3 centimetres a month.

The Colombian experiment has shown that rapid growth can take place at depths ranging from one to 3,000 metres below sea level. Sewerage pipes five centimetres thick have been grown in Colombia at a cost of between $20 and $30 a metre. This compares with about $2,000 a metre for the equivalent in steel. A Cuban experiment is planned to transport waste far out to sea through pipes grown in place and connected to coastal sewers. An electrified wire mesh frame will be laid in place, and Zapp said once the electrical current is disconnected the pipe will continue to grow and reinforce itself, but only from the outside which receives the light. Among the advantages of growing pipes, he said, are the very low cost of laying the frame, the absence of welds and the lack of maintenance. "The pipes will last indefinitely", he said.



UNDP JORGE ZAPP

Before, during and after

A major impetus behind the original project was the need to find a cheap alternative to asbestos, which is widely used in the developing world for roofs or insulation. Some members of the Colombian research team had visions of entire communities of coastal houses built from this environmentally safe marine 'cement'. Zapp said that the necessary forms can be built for a fraction of conventional costs. "We've proved that electro-accretion is a viable low-cost construction technology for the developing world", he said. ■

Pedal Power Promoted in Drive for Clean Air

As cities the world over struggle with fumes, congestion and man's undying love for the automobile, a small, determined group of people is reminding public policy makers that salvation has two wheels, not four.

The bicycle, they say, can dramatically improve the quality of life in our cities and the countryside, if Governments will only seize the initiative and support pedal power as an alternative form of energy for transportation.

Researcher Marcia D. Lowe of the Washington-based Worldwatch Institute maintains that the bicycle is the only vehicle that addresses car-induced urban problems while providing safe, convenient private travel, and she offers some persuasive statistics.

Lowe points out that more than half of all commuting trips in the United States, and 75 per cent of the travel in Britain, is over a distance of eight kilometres or less, and that bicycle commuters could become an important component of an effective clean air strategy. She notes that in the developing world, fewer than one p.c. of people can afford automobiles, but Western-trained engineers and car-driving elites have nevertheless skewed transportation decisions towards the motorized sector, leaving tens of millions of people on foot, with limited access to jobs, schools, markets and vital services.

Hostility

"In much of Africa and even more widely in Latin America, the prestige and power of auto ownership has made Governments ignore pedal power and led citizens to scorn the bicycle as a vehicle for the poor", says Lowe.

Sound policy making is critical to the effort to reduce auto congestion and pollution, but Lowe observes that city governments are often openly hostile towards bicycles and other human-powered vehicles, either discouraging them with fines and taxes, or wiping them out entirely through bans and confiscations.

"Dhaka, Bangladesh, recently threatened to phase out rickshaws despite the fact that they account for more than half of all passenger trips in the city and employ an estimated 140,000 people," she said. "In Jakarta, Indonesia, the city has confiscated some 100,000 rickshaws over the past five years and dumped them into the sea to "reduce traffic congestion". Rickshaws throughout South Asia, and even in some African cities, where they are less common, are also in jeopardy.

Rickshaws in jeopardy

Professor V. Setty Pendakur of the University of British Columbia, an authority on urban transport in South Asia, says that the cycle rickshaw provides optimum employment for low investment and serves the poor efficiently and flexibly by reaching areas not served by conventional buses. He says that while Governments typically defend their assaults on rickshaws by declaring them unsafe or inhumane for the drivers, their more likely motive is to clear the streets of vehicles which make the city look poor and backward.

"While there is a need to modernize and make the life of the rickshaw puller tolerable, the answer may not lie in costly motorization, but in better design of the cycle rickshaw and the streets," he says.

In Ghana, a World Bank project is supporting the production and use of bicycle trailers and handcarts, and is helping to build low-cost roads to be used mainly by non-motorized vehicles. The proposed roads will cost about $2,400 a kilometre, roughly 8 p.c. of the cost of conventional rural roads for heavy trucks.

Several other international agencies are also working with developing countries to design sturdy load-carrying

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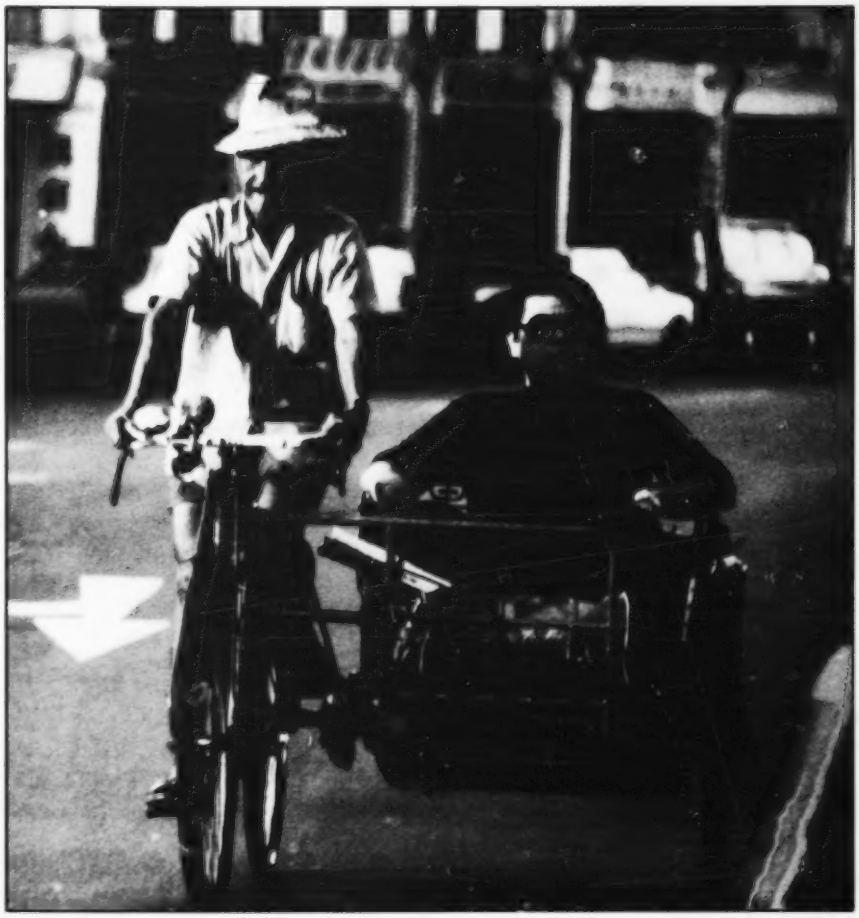

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Pedal Power
(Cont. from Pg. 3)

bicycles and trailers, and to improve vehicles for the disabled. At the Rural Appropriate Technology Centre in Madras, India, bicycles are being adapted so that they can be used both for transportation and to provide pedal power for implements such as paddy thrashers, peanut shellers and water pumps. A Canadian agency is redesigning the rickshaw, which was orginally developed for tall Europeans, into lighter, cheaper, and more manoeuvrable vehicles for typically shorter Bangladeshis.

Field studies by the British-based agency Intermediate Technology Transport Ltd., has shown that a bicycle can multiply a person's travel capacity (speed plus payload) five times over that of a pedestrian, and that by attaching a trailer to a bicycle, a rider can comfortably carry up to 200 kilogrammes. In Bangladesh, trishaws alone carry more tonnage than all motor vehicles combined.

Energy savings

Energy savings from pedal power are extraordinary. The Worldwatch study reports that a 10-mile commute by bicycle requires just 350 calories of energy, the equivalent of one bowl of rice. The same trip by an average American automobile uses 18,600 calories, or about half a gallon of gasoline. A study conducted in Britain in 1980 calculated that if just 10 p.c. of the car trips of less than 10 miles were made by bicycle the country would conserve 14 million barrels of oil a year.

Globally, Worldwatch observes that cars and other motor vehicles create more air pollution than any other human activity. Gasoline and diesel engines emit almost half of the carbon monoxide, hydrocarbons and nitrogen oxides that result from fossil fuel combustion world-wide.

Asia currently offers the largest body of experience with pedal power and stands to benefit most from it, if Governments and city administrators can be persuaded to support sound, established technologies such as bicycles, in harmony with motorized transportation. Bicycles in Asia currently provide transportation for more people than do all the world's automobiles combined.

"Most of the world's bicycles are in Asia", Lowe says. "China alone has roughly 300 million, more than one for every four people, or almost one for every two city residents. Traffic monitors at an intersection in the northern industrial city of Tianjin once counted more than 50,000 bicycles pass in one hour."

Bicycle manufacturing can also be a foundation for sound industrial enterprises in the developing world, serving as a source of local transportation and employment and a training ground for mechanics. Start-up costs are low. The Worldwatch study maintains that a small assembly plant and repair shop requires about $200 worth of tools, and that 100 bicycles can be manufactured for the same amount of materials and energy required to build a medium-sized car.

India has established a largely self-sufficient bicycle industry, first by assembling bicycles from imported parts and then by building the frames locally.

"From a modest beginning five decades ago, India has become a major world producer", says Lowe. "It directs more than 90 p.c. of its bicycle exports to other developing countries, and, through joint-venture and licence agreements, it is sharing its small-scale, labour-intensive techniques with countries throughout Asia, Africa and the Caribbean." ■

New Contenders in High Technology

The technological ranking of nations is in a state of flux, with a number of significant challengers to the long-established dominance of the United States.

Alan L. Porter, Director of the Georgia Institute of Technology, told participants in a CSTD seminar held in New York on 13 September that his institute had tracked the high tech output and export performance of 29 nations over five years and concluded that Germany and Japan had done almost equally well. He also said that the four strongest newly industrializing countries of Asia—Singapore, South Korea, Taiwan and Hong Kong—had achieved a standing comparable with middle-tier OECD countries, including Italy, Switzerland, Canada and Sweden.

Professor Porter noted that in each case, a strong socio-economic infrastructure, with an emphasis on education, was a precursor to technology-based growth.

An executive summary of the research results is available, free of charge, on request from the School of Public Policy, Georgia Institute of Technology, Atlanta, GA 30332-0345, USA. Copies of the two-volume report are available for $20 prepaid to the School of Public Policy. ■

ATAS News

A Technology Assessment Supplement

No. 14/Fall 1991

Photovoltaics Gain Market Share

The 1990s could bring an explosion in sales of photovoltaic systems (PVs). According to forecasts cited at a CSTD workshop in Sao Paulo, Brazil (16 - 20 September) the world PV market is expected to grow from 45 mW in 1989 to 200 mW in 1993, and 450 mW by 1995.

Although these systems, ranging in output from a few watts to projected commercial applications of 200 mW net capacity, have far to go before they scratch the surface of world demand for electricity, they have established a foothold which can only become more secure.

The price of PV modules has fallen to about $5 a peak watt and in the African Sahel the use of solar-generated electricity in the capacity range of 5-10 kW is now more attractive than conventional energy sources. Costs will continue to fall, but solar power has already become a priority option for many of the world's poorest communities.

The CSTD workshop examined the state-of-the-art in PV technologies, and their prospects for the near and medium-term, with special attention to dissemination problems and market penetration.

Constraints

Participants noted that:

• Although solar energy is free after installation, the greatest constraint to the dissemination of PV systems in poor rural areas is a lack of financing for end-users to make the down payment. Creative financing in this market is in its infancy, they said.

• Artificial prices for conventional sources of energy distort the market, which fails to reflect the low recurrent costs and low environmental impacts of PV systems.

• Energy planners, decision-makers and the general public have insufficient knowledge of solar technology.

• R&D related to PV technology is too low in all but a few developing countries to support an indigenous industry. Growth of the market remains heavily dependent upon technology transfers.

Workshop participants recommended that a joint programme supported by developing and industrialized nations should raise the necessary financing to install one million PV systems in the developing world by 1995. A programme on this scale, they said, would improve the lives of only 1 per cent of the world's rural poor, but it would hold

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Conference in Tunisia

The Ecole Nationale des Sciences de l'Informatique will host the sixth International Conference in Computer Science (JISI '92) in Tunis from 20-22 May 1992.

Submissions in English or French are invited on the subject of computer information systems in the specific areas of Architecture and Organization; Design and Management; Set-up and Security; and Decision Support.

For further information please contact: Montasser Oualli, JISI '92 Chairman, Ecole Nationale des Sciences de l'Informatique, PO Box 275, Cité Mahragene 1002, Tunis, Tunisia. Fax: 787827. ■

Demystifying Technology for Human Development

A remote village in the northern Indian State of Rajasthan has become a beacon of hope for poor rural communities living beyond reach of reliable electrical power supplies.

Since 1988, the village of Tilonia has been home to the Social Work and Research Centre (SWRC), which has devoted itself to the demystification and dissemination of technologies which local people can afford to install and maintain. Drawing on the bounty of a desert state which has sunlight for more than 300 days of the year, the Tilonia Centre is using solar power as a bridge between technologists and beneficiaries who are still largely dependent on oxen and manpower for agriculture and transportation.

The Centre is training rural youths with high-school education to become competent hands-on technicians able to install and maintain solar photovoltaic cells (SPVs). Their introduction to the concept of solar power was the construction of the centre itself which has a 7 kW capacity, supplying illumination (3 kW) through tube lights ranging from 5 to 30 watt strength, as well as power for hardware (4 kW) for computers, refrigeration, television, VCRs, slide projectors and soldering equipment which is used in the production of electrical charge controllers. Solar powered water pumps distribute 30,000 litres of water a day for washing, drinking and other purposes.

The Director of the Centre, Sanjit "Bunker" Roy, reports that amenities for people in the surrounding areas have picked up considerably since the Centre established itself in Tilonia. Trainees from the Centre have installed SPVs in 30 night schools for rural villages, enabling some 1,500 girls and boys so far to learn how to read and write. The Government of India has commissioned the Centre to install another 300 SPVs in eight other States to provide lighting for adult education classes which also run in the evenings.

The state government of Jammu and Kashmir has also commissioned the Centre to "electrify" 500 houses this year in villages which are cut off from the surrounding world by snow for six months of the year.

Success has not spoiled the Centre. Its essential mission remains that of introducing the rural poor to solar power, keeping costs down and ensuring that those who want solar electrification are capable of maintaining a reliable supply.

The Centre still uses glove puppets to introduce villagers to the opportunity, and their travelling show makes its way over broken roads and pathways by tractor trolley or animal-drawn carts. But when the sun goes down and people would normally light their lanterns and candles, or move closer to their cooking fires, the Centre dazzles its audience with electric light generated from solar units mounted on the back of an ox-cart. ■

Photovoltaics gain

(Cont. from Pg. 1)

the door open to a targeted 10 per cent by the turn of the century.

Other agencies supporting the workshop, together with the Government of the State of Sao Paulo and relevant Brazilian federal ministries and organizations, were UNU, UNFSTD/UNDP, UNIDO, UNESCO and DTCD.

The workshop was attended by more than 140 people from 22 countries as a follow-up to previous CSTD activities in the fields of new materials (ATAS 5), energy (ATAS 6) and environmentally sound technologies (ATAS 7). A conference report will be available before the end of the year. The proceedings of the conference will be published early next year. ■

New Technologies Help Contain Energy Costs

By Charles J. DiBona

By applying new technology to an old business—extracting oil and natural gas from deep within the earth—the petroleum industry is helping to diversify supplies and contain the costs of energy. Three recently developed advanced technologies already in widespread use are horizontal drilling, three-dimensional seismic surveys and measurement-while-drilling.

Horizontal drilling

Turning the drill so that it bores parallel to the earth's crust—rather than continuing vertically once it enters the oil formation as in conventional drilling—produces more energy from fewer oil and gas wells. This technique also minimizes any potential environmental impact by reducing the size and number of visible drilling rigs.

Equally important, horizontal drilling raises production in older oil and gas fields. For example, conventional vertical wells in a 50-year-old United States oil field in south Texas have yielded less than 30,000 barrels on average. Horizontal wells drilled in the same field have yielded more than 100,000 barrels, and some will yield more than 300,000 barrels of oil.

Experimental horizontal wells were first drilled more than a decade ago. By 1985, there were four horizontal wells in commercial operation. By 1989, there were nearly 300, and in 1990 the number will jump to 800. The development of the complementary technologies—three-dimensional seismic surveys and measurement-while-drilling—was the key to the commercial success of horizontal drilling.

Three-dimensional seismic surveys

As physicians use X-rays to look into the body, geologists use a technique known as tomography to obtain three-dimensional pictures of oil and gas

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Looking for the 'Right' Answers from Technology Assessments

By Lynton K. Caldwell

Since their advent in the 1960s, the techniques of impact analysis and technology assessment have become major tools of planning and decision-making in relation to the environment and development. That they are valuable instruments for rational policy-making has been clearly demonstrated. That alone they are capable of providing the "right" answers to all questions of policy for environment and development has not. To benefit from these analytic techniques, their rightful relationship to planning and policy-making should be understood and institutionalized. The relationship is not simple and itself requires an analytic approach.

Not panaceas

A common error of advocates for impact analysis and technological assessment is to treat them as if they were panaceas for rational decision-making. The techniques cannot determine what policies should be pursued. They can, however, reveal the probable consequences of policy decisions and their implementation. Thus they may strengthen the exercise of foresight and prudence, two qualities which history reveals as chronically deficient at the higher levels of political decision-making.

The El Dorado of many policy-makers today is a technological substitute for personal decisions, which, however rational, are certain to be impolitic, will be opposed by influential forces and may be politically difficult to defend. Impact analysis and technology assessment hold the promise of being ostensibly neutral technologies that may be managed to justify preferred choices, or may be ignored without offense to politically powerful constituents. These options, however, may be negated by organized public opinion sufficiently focused and activated to insist upon the integrity of the analytic procedures and, more importantly, to clarify the objectives towards which they are deployed.

There is little substantive benefit to be gained from perfecting analytic techniques, training analysts or establishing systems for monitoring and reporting of trends until, and unless, the objectives of policy have been agreed upon. The ambiguity and lack of specificity in much, perhaps most, of the literature on environment and sustainable development indicates that the actual conditions of nations today, and their prospects for change, have received insufficient attention.

If we are to address intelligently, and cope with, the issues of environment and development, we must understand why these issues have arisen at the present time and the direction towards which events and popular opinions appear to be tending. If we lack the patience to understand the societal context in which environment-development issues have arisen, we are unlikely to bring them under rational control, regardless of our technological innovations. ■

Dr. Caldwell

Dr. Lynton Keith Caldwell is widely recognized as the 'father' of the environmental impact statement. He was a principal architect of the National Environmental Policy Act of 1969 (USA) and is currently the Arthur F. Bentley Professor Emeritus of Political Science and Professor of Public and Environmental Affairs at Indiana University. The above contribution was extracted from a presentation he made to a CSTD seminar at United Nations Headquarters in September.

Workshop in Hanoi

The fruits of biotechnology will be increasingly visible on world markets during the 1990s and in the short term at least the commercial benefits will be greatest in the industrialized world.

There is, however, a high spin-off potential for developing nations, particularly in the areas of soil fertility, crop production and food processing.

An international workshop will be held in Hanoi from 10-12 December to examine the implications of genetic engineering and other technologies for third world countries and for Viet Nam in particular.

The workshop will address the need for endogenous capacity not only to apply new technologies but also to weigh the potential risks and benefits inherent in crop substitution and trade, and in new processes which could endanger the natural environment, biodiversity and social organization.

Nations such as Viet Nam are vulnerable in all these areas and careful forward-looking planning and institutional preparation are needed to cushion shocks and exploit opportunities.

The workshop is being organized by the National Institute for Scientific and Technological Forecasting and Strategy Studies (NISTFASS) and by CSTD as a follow-up to its ATAS Bulletin on "Tissue Culture Technology and Development". An earlier biotechnology workshop was held in Dakar, Senegal, in October 1990.

The immediate aim of the Hanoi workshop is to analyse the application of biotechnologies for increased food production and to produce policy guidelines which would support that objective. ■

Oil Extraction
(Cont. from Pg. 2)

reservoirs. The technique involves sending sound waves from one well to listening devices in another well up to half a mile away.

Petroleum geologists use different tools at different stages in the exploration process. They usually begin the search for oil and gas with conventional two-dimensional surveys. Once they find a promising site, they conduct three-dimensional seismic surveys to reveal faults clearly so oil and gas reservoirs can be mapped accurately.

Another advanced technology produces studies known as cross-hole surveys which reveal the internal structures of oil and gas reservoirs and help determine the best locations for production wells.

Using recently developed, high-capacity computer hardware and software to analyse data from their own surveys as well as other sources, petroleum engineers determine the best locations for oil and gas production wells. The comprehensive information obtained during the exploration process also tells them where not to drill—where the investment in drilling is unlikely to be rewarded by an oil or gas find.

Measurement-while-drilling

This advanced technology helps avoid costly and time-consuming equipment failures, resolve downhole problems and monitor routine performance factors. For example, it can indicate when a drill bit is ready for replacement.

Measurement-while-drilling is a generic term for a wide range of tools: navigation sensors that locate the drill bit, mechanical sensors that record wear on the bit, circulation sensors that monitor drilling fluids, and formation sensors that provide information about the rock that is being drilled. These tools enhance understanding of what is happening at the rock face and increase the productivity of each well drilled.

As the technologies discussed above illustrate, advances in petroleum exploration and production are vital to fulfilling the challenges of the decade ahead: to find and develop new sources of energy while maximizing the recovery of oil and gas from existing fields. ■

Charles J. DiBona is President of the American Petroleum Institute.

Atomic Agency Outlines Nuclear Power Trends

Nuclear power production worldwide will continue to grow well into the next century, accordinng to the latest estimates of the International Atomic Energy Agency (IAEA). The Agency expects growth to average between 1.7 and 2.9 per cent a year until the year 2010.

The high-growth areas will be the Middle East and South Asia 14.5 to 17.1 per cent; Latin America 7.0 to 8.1 p.c.; Eastern Europe 4.6 to 6.5 p.c.; and Africa 1.5 to 6.5 p.c.

The industry leaders, however, are cutting back. Although electricity production from nuclear power stations rose by 4.1 p.c. last year among the OECD countries of Europe, North America, and Asia and the Pacific, a recent survey by the OECD's Nuclear Energy Agency suggests that the share of total electricity demand to be met from nuclear sources will stabilize at around 21 p.c. by the year 2000, down 2 p.c. on the 1990 figure. ■

"Ultra" Rice for Hungry Populations

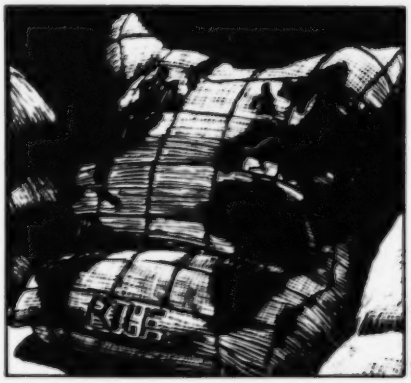
Scientists at the International Rice Research Institute (IRRI) in Los Banos, Philippines hope to have an ultra-high-yielding rice variety ready for release to farmers in five to eight years.

"Rice yields have doubled over the last 25 years, but irrigated rice seems to have reached a yield plateau", said Dr. Gurdev Khush, IRRI's principal plant breeder. "A different plant type may raise the yield in the dry season from today's 9 tons to 13 tons, and maximum yields in the wet season may increase from 6 to 8 tons."

The current average rice yield in the Philippines is 2.8 tons per hectare, with irrigated fields averaging 4 tons

The ideal new rice plant would stand 90 to 100 cm high and be ready for harvest between 110 and 130 days after seeding. Its heavier grains would have better milling quality and would yield fewer broken grains than current varieties.

The new variety would also demand less labour. While most modern varieties were developed for transplanting, the new type would follow a trend towards direct seeding and better weed control to offset farm labour shortages. ■



BRIAN LIES

ATAS News is a regular supplement to the *Update* newsletter of the UN Centre for Science and Technology for Development (UNCSTD). Its objectives are to inform scientists and planners of CSTD's activities in technology assessment (TA), to serve as an information medium for the ATAS Technology Assessment Network (TAN) and to highlight the implications of new technologies for developing countries. *ATAS News* offers readers an open forum to address these and related issues at the national, regional and international levels. Submissions for publication are welcome.

Newsworthy articles, special reports, and photographs and other illustrative material should be sent to: ATAS Cluster, UNCSTD, 1 U.N. Plaza, N.Y., N.Y. 10017, USA. Telex 232422 UNHUR and 62450 UNATIONS. Cable, UNATIONS NEW YORK. Telefax (212) 9634116.

ATAS News is edited by Ian Steele. ■

Striking a Balance with Nature

By Dhira Phantumvanit
and Claudia Winkelman

Environmental concerns in the developing countries of the Pacific Rim are widespread and challenging. The region combines some of the world's fastest-growing economies with some of its most delicate ecosystems. Issues of concern in the region include global climate change, tropical deforestation, urbanization, expanding energy use and the disposal of solid and hazardous wastes.

The overriding question, however, is how to find an optimal trade-off between the environment and economic development. To strike such a balance, environmental consequences clearly must be carefully weighed against the financial benefits, proven or potential, of development projects.

Global warming

Global warming will affect all nations to varying degrees. Within the developing countries of the Pacific Rim, a warming of the atmosphere might cause changes in rainfall and humidity. It might also raise the sea level through thermal expansion and melting of the polar ice caps. These changes could affect agriculture, human settlements and, in some cases, the very existence of small island nations such as the Maldives.

The Pacific Rim countries are ill-equipped to deal with the massive social and ecological disruptions which might result from global warming. And yet, development projects in these same countries enhance the likelihood of this phenomenon. Newly emerging industries and the increasing use of cars and trucks reflect the region's increasing affluence, while also contributing significantly to fossil-fuel usage and greenhouse-gas emissions.

Deforestation

Significant deforestation has occurred as a result of infrastructure development, shifting cultivation and commercial logging. The contribution of these activities to economic development is clear, but their environmental costs are far-reaching and unsettling. In addition to releasing greenhouse gases, deforestation reduces the water-retention capacity of soils, thereby causing flooding. It also destroys the natural habitat of highly valuable diverse tropical plant and animal species which now survive, by and large, only in the world's vanishing tropical forests.

Urbanization

Explosive urbanization and overcrowding are occurring across the Pacific Rim. The environmental consequences include greater traffic congestion; insufficient and unsafe water supplies; inadequate sewerage and solid and hazardous waste disposal; and increasingly hazardous air emissions from cars, buses, motorcycles and industries. These factors combine to lower the quality of life and reduce the population's productivity. In addition, a lack of proper urban infrastructure discourages both local and foreign investment.

Energy

By the year 2000, if present trends continue, energy requirements could increase by as much as 85 per cent in some developing countries of the region. To meet that demand would require enormous expenditures for administration, training, construction and maintenance. Energy conservation therefore should be a primary goal for all Pacific Rim nations. The introduction of tax subsidies would create incentives for greater energy efficiency and conservation, thereby reducing the need for added power-generation capacity. Tax incentives would also encourage the choice of cleaner energy sources.

The time has come for Pacific Rim nations to recognize and act upon the fact that economic development cannot be separated from society's other problems. Environmental management is an integral part of development, particularly in those countries facing an economic transition from agriculture to industry. A forward-looking strategy is clearly necessary. And by acting now, costly technological adjustments and clean-up costs can be held to bearable levels.

As countries develop their industrial bases and encourage foreign investment, they must do so in ways which generate the highest possible benefits for their people at the lowest and least painful costs. ■

This article was extracted from a paper published recently in the *Quarterly Review* of the Thailand Development Research Institute.

Annual Islamic Conference

The fifth annual conference of the Islamic Academy of Sciences will be held in Amman, Jordan, from 16-19 December.

This year's theme is "Science and Technology Manpower Development in the Islamic World". The conference objectives are to:

- discuss policy issues related to manpower development, including the allocation of resources, the role of the private and public sectors, and the consistency of S&T manpower development with national objectives.
- assess the state of S&T manpower development in the Islamic world.
- consider ways of strengthening national, regional and international cooperation in S&T manpower development among Islamic countries. The role of regional and international agencies in the strengthening of national efforts in this regard will also be examined. ■

China and India Follow Different Paths Towards New and Renewables

By Walter Shearer

While most nations relaxed their efforts to develop new and renewable sources of energy (NRSE) during the "oil glut" of the 1980s, a handful of developing nations continued to diversify research and development efforts and expand them into major programmes. Much attention has focused on the initiative of Brazil, with its large biomass projects, but the less publicized programmes in China and India are at least as impressive. The institutions these nations have built to promote NRSE research and development are based on quite different concepts, which invite comparison.

China

China has built a vast network of NRSE research and development institutions which resemble the network of agricultural research institutes of the CGIAR (Consultative Group on International Agricultural Research). The network is focused on single energy sources (e.g. solar energy) or technologies (e.g. photovoltaics), but also does a wide range of NRSE work relevant to individual provinces or regions. Eight Government NRSE institutes form a co-ordinated network of national-level research, development and promotion centres specializing in specific energy sources. They are assisted by 14 institutions of broader scope established by various Government agencies and ministries as well as the Chinese Academy of Sciences (CAS). Usually, one unit in each of these institutions is devoted to research on a particular energy source or technology. The network extends to the regional level through 16 research institutions, supported by the CAS and the provincial and municipal governments and focuses on the mixture of NRSE available in each local region. This makes for a dynamic, responsive research and development organization capable of dealing with NRSE research and development at all levels.

Not all of the 56 research and academic institutions in China dealing with NRSE are part of the network. But departments and laboratories in ten universities and eight university research institutes and centres contribute by producing trained experts to staff the Government institutes. At least half of the Government institutes were built over a period of a little more than a decade, increasing the total technical staff to about 3,000 engineers, researchers and professors. The results can be seen in the installation and continued operation of solar, biogas, small hydropower, wind and geothermal energy systems.

India

India's approach has not been as centralized. India has about 100 institutions working on NRSE; some are funded publicly, others privately. Most NRSE research is carried out in small units within institutions that are primarily responsible for work in other fields. These units attempt to develop NRSE systems for the main area of responsibility of each institute, by working closely with researchers in fields as diverse as agricultural engineering, building technology, water resources development, forestry, waste recycling and sugar production. Units in these institutes account for half of the research centres dealing with NRSE in India. Many are managed by the Council of Scientific and Industrial Research or by the Indian Council of Agricultural Research.

In total, about 19 Government, private and university research centres are devoted to NRSE, but departments and laboratories in 32 universities are also undertaking research on NRSE. The emphasis in India is on diversity, with some Government support and strong participation from the academic community. This approach relies on research innovation from a multitude of academic and application-oriented institutions, and leaves a few large Government agencies with the task of implementing big development and dissemination projects.

Another major difference between the Indian and Chinese approaches is the size of their research centres. In China, the technical staff of the institutes tends to be large, often numbering in the hundreds, while in India the numbers are usually small—between 10 and 20.

It is difficult to judge which approach will prove more productive. It remains to be seen if the very large staffs of institutes in China are an advantage and if enough of the multitude of small staffs of Indian centres, while stimulating research competition, are above critical mass.

It is also difficult to know where these paths will ultimately lead. Although the approaches have produced research and development institutions which are very different in character, changes occasionally occur which appear to bring the approaches closer. One example is a decision in recent years to insist that Government (i.e. non-university) institutions in China seek funds for a portion of their research and development activities through factories set up to manufacture and sell the NRSE systems they design. This relieves the Government of some of the burden of financing NRSE research and development by bringing in private funds, something that is commonly done in India in a number of other ways.

A guide

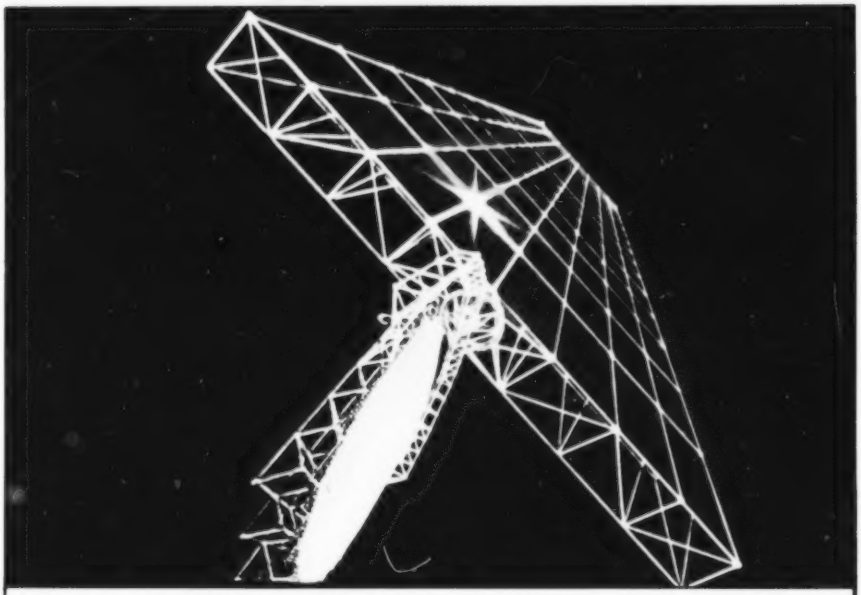
With the renewed interest in NRSE that is bound to follow increased concerns for the environment and recent increases in the price of oil, the experiences of China and India can serve as a guide for other developing countries. It appears fortunate indeed that some nations have tried to prepare for the time when NRSE will be an essential element in the overall energy picture. ■

Walter Shearer is a UNU senior programme officer who is currently working with UNCSTD.

Power from Space: An Option for the 21st Century

By Dr. Peter E. Glaser

In a remarkably short time, we have witnessed the unmanned exploration of the solar system and manned landings on the moon and achieved access to space for an increasing variety of significant applications. By the year 2000, permanent human presence in orbit will set the stage for extensive exploration of the moon and Mars in the 21st century. In an era in which exponential population growth and the insistent drive for economic growth are threatening to deplete global natural resources, the inexhaustible energy and material space resources can be developed to meet global needs.



ARTHUR D LITTLE

Solar power satellite—model

New strategy needed

The ever-growing list of threats to life on Earth includes global warming, stratospheric ozone depletion, the disappearance of species, deforestation, pollution, famine, political instability and potential nuclear holocaust. In order to safeguard the biosphere as a home for humanity, we must develop a strategy that no longer relies solely on terrestrial resources but draws on the boundless accessible resources in the solar system. Even with the most stringent energy conservation measures, the escalating demands for food, shelter and an equitable living standard for the world's population cannot be met unless we develop new energy sources environmentally acceptable on a global scale. We can still follow a new path before these global challenges overwhelm us. The key to meeting them is to develop energy options that rely increasingly on solar energy resources for use on Earth and in space, and to utilize materials obtained from the moon, asteroids and other solar system bodies for the construction of solar power satellites (SPS) and the supporting space infrastructure.

The objective of the SPS is to convert solar energy in space for use on Earth. Its most significant benefit is the potential for continuously generating large-scale electric power for distribution on a global basis.

An SPS system would consist of satellites in geosynchronous Earth orbit, each SPS beaming power to one or more receiving antennas at desired locations. The SPS system concept, as evaluated by NASA and the U.S. Department of Energy in the 1970s, would provide 5000 MW of electric power to the Earth from a single SPS. Microwave beams, or laser beams, would transmit the power generated by the SPS to receivers on Earth. As early as 1975, a microwave-receiving antenna located on Earth was demonstrated to be capable of converting microwaves beamed across one mile into electricity with an efficiency of 85 per cent, thereby reducing dramatically the heat release to the environment at the power beam receiving site. New designs using advanced structural materials, technologies and efficient solar conversion systems would substantially reduce the mass, allow various capacities of power to be delivered to Earth, and further enhance SPS feasibility.

Solar radiation received in geosynchronous orbit is available 24 hours a day for most of the year. With this year-round resource availability, SPS could generate base-load power on Earth with a minimum requirement for energy storage. This power could be distributed globally to reduce significantly the use of non-renewable resources. The use of lunar resources including metals, glasses and oxygen would provide commodity materials for the construction of an SPS system in geosynchronous orbit. Possibly as much as 95 per cent of the total SPS system mass can be obtained from the moon at transportation costs a tenth of the cost of Earth-launched payloads without affecting the atmosphere because of reduced launch requirements.

Generating power for use in space is already of great value to space missions. It is the first step towards the development of technology options to supply power from space for use on Earth. The development of the technologies required for space power application in the 1990s can be accelerated. With these technologies, a growth path can be established to achieve, in demonstrable steps, the vision of opening up new resources to benefit humanity and enhance the value of the space exploration to meet global energy needs. The development of space power for use first in space, then on Earth, represents significant commercial opportunities with definable values at various stages of

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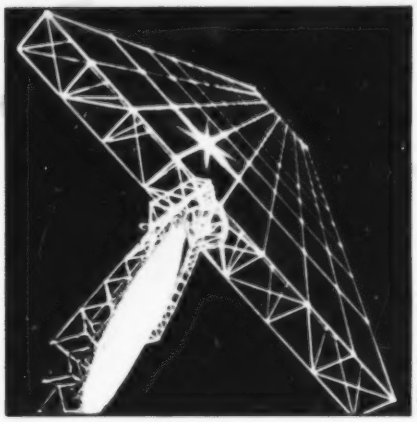

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Power from space
(Cont. from Pg. 7)

technology readiness, demonstration of economic returns and definition of follow-on steps.

Space power has been the enabling technology for achieving the objectives of space missions since the dawn of the space era. Photovoltaic arrays, fuel cells, nuclear isotopes, batteries and associated controls and equipment have and continue to be essential for satellite operations. The advancement of these power generation technologies for diverse applications such as space platforms, communication, remote sensing, navigation satellites, scientific experiments and astronomical observations, demonstrate that power generation systems for use in space have already achieved a high level of sophistication. The next step should be to beam power to permanently manned space stations to supplement the available power.

Unmanned, reusable and free-flying platforms for multiple uses are being designed to serve applications ranging from remote sensing to experiments in communications, science and power beaming. The Japanese Space Flyer Unit (SFU) is reusable and designed as an element of space systems operated by the space shuttle crew. The SFU is scheduled to be launched on the H-II launch vehicle in 1993 and retrieved by the space shuttle in 1993 or 1994. The SFU is to be used for the Microwave Energy Transmission System project by the Institute of Space and Astronautical Science and several Japanese universities. A demonstration of a "Powersat" is being planned by Eurospace with the cooperation of several leading European aerospace organizations and utilities.

Demonstration in 1992?

The Center for Space Power, Texas A & M University, has proposed a space power demonstration which is to be part of the International Space Year starting in 1992. A microwave beam generated aboard the shuttle is to be directed towards a receiving antenna held by the remote manipulator arm and, during a future mission, beamed to a free-flyer.

Soviet inputs

Development of microwave beaming in the Soviet Union has already been discussed by representatives of the USSR Academy of Sciences at the 1985 International Astronautical Congress in Stockholm. Current work at several USSR institutes is concerned with both microwave and laser beaming.

Studies are under way to assess the feasibility of beaming power from a generating plant on Earth to a reflector in geosynchronous orbit and back to a receiving site at a great distance from the generation source, and to lunar and Martian bases from an orbiting satellite. Beamed power can also be used for propulsion either from low-Earth to geosynchronous orbit or for transporting payloads from the moon to low-Earth orbits, and eventually from the moon to Mars.

Formidable challenges

The challenges to developing extraterrestrial energy and materials resources are formidable. But we can start to supply power to the evolving space infrastructure so that the most viable technology options can be selected, demonstrated and applied to SPS development to stave off the challenges faced by humanity in the 21st century. Making the transition to 21st-century energy production methods that are compatible with Earth's ecology will require international co-operation over a period of decades. A sustained and significant level of effort is essential, given the gravity of the challenges facing us. Space-faring countries are in a position to participate in this effort, address the most critical needs and develop the global applications. The question is no longer whether humanity can effectively use space resources, but how best to achieve this goal. ■

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"...A periodic newsletter to keep national authorities, United Nations organizations and intergovernmental and non-governmental organizations informed of the progress made and related developments regarding the implementation of the Vienna Programme of Action" (IGC resolution 5(II)).

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